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Exploring Delegate Engagement with an Augmented Conference

Nick Taylor¹, Tom Bartindale², John Vines², Patrick Olivier²

¹ Eclectric Research Studio
University of Dundee
Dundee, UK
n.x.taylor@dundee.ac.uk

² Culture Lab, School of Computing Science
Newcastle University, UK
{tom.bartindale, john.vines,
patrick.olivier}@newcastle.ac.uk

ABSTRACT

We describe a qualitative study of delegate engagement with technology in academic conferences through a large-scale deployment of prototype technologies. These deployments represent current themes in conference technologies, such as providing access to content and opportunities for socialising between delegates. We consider not just the use of individual technologies, but also the overall impact of an assemblage of interfaces, ranging from ambient to interactive and mobile to situated. Based on a two-week deployment followed by interviews and surveys of attendees, we discuss the ways in which delegates engaged with the prototypes and the implications this had for their experience of the conferences. From our findings, we draw three new themes to inform the development of future conference technologies.

Author Keywords

Conferences; ubiquitous computing; public displays; social media; Twitter; backchannel.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Academic conferences are environments where delegates wish to absorb information, build relationships amongst the research community and be inspired and energised. Consequently, technologies allowing delegates to better communicate with fellow attendees and access conference materials have become increasingly common, with mobile devices and social networks in particular now a key element in the experience of academic conferences. As a group who routinely work with novel technologies, this is particularly

visible in the HCI and ubiquitous computing communities. This motivates us to more closely examine how delegates engage with technology in the conference environment.

Taking current trends seen across HCI conferences and existing research into conference technologies, we see the following themes emerging:

- Supporting delegates in meeting new people and entering into discussions, both in person and through additional digital channels.
- Making content generated before, during and after the conference—such as papers, videos, photos and tweets—available and searchable through multiple channels.
- Ensuring that these technologies are not disparate entities, but form part of an interconnected and engaging conference experience.

Despite many examples of individual prototypes that address the first two properties, there is a lack of understanding in terms of how they integrate with each other and the wider conference experience. Engagement with technology in public spaces is “characterized by the interplay between physical and spatial conditions, socio-cultural practices and constructs and content of installations” [9]. A delegate’s trajectory [2] through the conference experience transitions through a number of different roles, at different times and in different locations, both physical and digital, interwoven with the trajectories of other delegates. During this time, delegates access the conference through a number of different interfaces for different purposes, but which should be considered to form part of the same overall act of interacting with the conference. As such, we believe it is important to study the impact of multiple technologies working together and integrating with the wider conference experience.

In an effort to study conference technologies in a holistic manner, we have studied an assemblage of technologies—ranging from ambient to interactive and mobile to situated—that are representative of current trends and past research. These were deployed across two academic conferences, DIS 2012 and Pervasive 2012, held over two consecutive weeks in Newcastle-upon-Tyne, UK in June 2012. The first of these was dedicated to the design-oriented aspects of human–computer interaction, while the

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second was a more technology-focused conference dedicated to ubiquitous computing. By being in place throughout the conferences, these deployments were able to act as technology probes [16] that served to challenge the conference experience and provoke responses from attendees on the role of current technologies and potential future technologies in the conference environment. Through this deployment, we ask how the conference experience was affected and what we can learn to inform future conference technologies.

In this paper, we examine how delegates engaged with an augmented conference environment. We contribute a qualitative analysis of delegate interviews and questionnaire responses that exposes the impact of technology on the conference. From this data, we draw key findings that will be valuable in informing future attempts to develop conference technologies and in understanding and making the best use of the many technologies that have already become part of the typical conference experience. We conclude by contributing a new set of themes to inform and inspire the development of future conference technologies.

BACKGROUND

There has been much precedent for deploying technology in conference venues and widespread adoption of mainstream technologies as a way of mediating conference experiences. The trends of encouraging social activity and making conference content visible are represented in a large number of trial deployments at past conferences. In the following sections we provide an overview of this prior work, focusing on interaction in public space, connecting and networking, making conference-related content visible, and providing backchannel communication.

Interaction in Public Space

A number of frameworks have been developed that account for the behaviour of groups and individuals in public spaces. Brignull and Rogers [5] highlighted how bystanders in a public space can be engaged in different ways. They defined three zones of interaction: peripheral awareness, focal awareness and direct interaction. Enticing potential users to transition between these spaces—first focusing upon a display and then moving to interact—is a significant challenge, which relies on social factors as much as the design of the system. This transition through multiple stages of interaction and different roles has been widely reflected in other research [2,26] and is a critical challenge for any deployment in public space.

Dalsgaard *et al.* [9] suggest that engagement in public space is a combination of cultural elements, physical presence and actions, media content and social factors. Schroeter *et al.* [23] further build on this to identify a ‘sweet spot’ for engagement, where the right combination of people, location and content lead to higher levels of engagement. As such, in designing technologies for use in the broadly public space of an academic conference, we must consider

more than just the technology in isolation, but consider it as situated in the broader context of the conference.

Connecting and Networking

For many, conferences are a time to network and build new relationships. However, these opportunities are “unevenly distributed among the attendees” [18], favouring more experienced or extroverted delegates. Many conference technologies have sought to promote better networking [12] by identifying attendees, suggesting potential beneficial contacts and offering icebreakers and other prompts to encourage social activity. Often, these have built upon the familiar concept of a conference badge, which is a common means of identifying others and a convenient placement for sensors, emitters or small displays [3,8,15].

Possibly the best known example, combining a number of different technologies, was the deployment of AutoSpeakerID and Ticket2Talk at UbiComp 2003 [18]. These systems both utilised personal tags that identified speakers asking questions and offered conversation topics to attendees standing near proactive displays. This study is noteworthy for also examining the impact they had on the overall conference experience. The authors concluded that they were perhaps overly cautious in attempting to maintain privacy and integrate the technologies into existing conference practices. Few attendees had major privacy concerns, while it was found that “meshing with existing practices may not be a reasonable goal” [18] when deploying technologies into venues. This suggests that it may instead be appropriate to deploy more radical interventions into the conference environment.

Making Content Visible

Much research into conference technologies has aimed to make the content of the conferences visible and searchable. In addition to the traditional paper programme, many conferences now make a mobile app available. This typically includes the full programme booklet and the ability to create a personalised schedule and reading list. Mobile applications such as the Conference Assistant [10] have also been used as recommender systems intended to help attendees navigate a large number of sessions.

Public displays have been one of the most common forms of conference technology. Large non-interactive displays of scheduling information have been common for many years, and interactive displays are becoming increasingly common, such as the widespread deployments seen at CHI 2013. Utilisations have included information about the conference and its host city [1,22], sharing of user-generated content such as photos [17] and for navigating around the venue [24]. Displays have also served as a means of connecting the conference’s online presence with the event itself, blurring the distinction between online and offline interaction. For example, CHIplace and CSCWplace [7] were online communities running before the

conferences, which were linked to interactive screens around the conference venues.

Backchannels

As networked technologies have become pervasive, connections between attendees have extended beyond face-to-face social activity. Various technologies have been used to create digital ‘backchannels’ at conference events—a secondary communication channel that occurs at the same time as presentations and face-to-face interactions [19]. Although backchannels have been most recently and visibly realised through Twitter, conferences had previously experimented with IRC channels [19]. These were used for a variety of purposes, including discussion of presentations and talks through to personal logistics such as ascertaining a colleague or friend’s location. Backchannels have also been utilised in more direct roles in presentations, including discussion with the presenter’s co-authors [21], or as part of the questions segment of presentations. For example, a backchannel can be used for clarification on small points, or to submit questions in advance so that the session chair is better able to curate the discussion and select interesting topics [14]. Visualisation of backchannel content has also been explored as a means of exposing this content to a wider audience [11].

However, concerns have been raised about the effect of backchannels on the amount of attention paid to presentations themselves [19]. Additionally, when these backchannels have been made visible, the lack of interesting content and the prevalence of social media syntax (such as hashtags and short-form URLs) have caused audiences to dismiss it [6]. Furthermore, uncertainty about who might be reading and about appropriate forms of content have discouraged posting [20].

Private, secondary sources of content can also be made available to presenters and session chairs. Most obviously, this might include features such as PowerPoint’s presenter view, which can be seen only by the speaker, but research in this area has explored other means of providing subtle notifications to presenters, such as by haptic feedback [25].

THE AUGMENTED CONFERENCE

Despite a wealth of research exploring the potential use of technology in the conference environment, little work has been conducted to explore the impact of technology on the wider conference experience. Although McCarthy *et al.* [18] went some way towards addressing this issue in 2004, the use of technology at conferences has changed dramatically in the last decade. Since their landmark study mobile devices have become ubiquitous at such events, and social networks, particularly Twitter, are used extensively as digital backchannels during conferences.

To explore this issue, we deployed a suite of technologies that are representative of both current trends in conference technologies and past research on the subject. With these



Figure 1. Interactive tables showed content generated before and during the conference.

technologies, we intended challenge the expected conference experience and stimulate discussion around the role of technology at such events. In the following sections, we describe components that comprised our augmented conference.

Content

The variety of interfaces deployed around the conference drew from a single central repository of content. This included the conference programme, submitted papers with author information and images and video associated with the papers. During the conference, the conference organisers generated additional photos and videos, including recordings of each presentation and interviews with delegates captured by a roving film crew. Photos uploaded to a designated Flickr group by attendees could also be automatically added to repository.

Tweets relating to the conference were collected and cached. As with most conferences, a hashtag was provided that allowed attendees to search for tweets relevant to the conference. In addition, each individual session was given a hashtag: for example, the opening keynote had the hashtag #keynote1. These were intended to make the backchannel more easily searchable and navigable by allowing attendees to identify tweets from specific sessions. A member of the conference staff vetted each tweet to ensure that offensive or irrelevant content was not posted on the displays.

Each attendee was given a unique digital identifier that was tied to content in the system (such as papers and videos) that had been authored by that user. An infrared tag in the conference badge was used to broadcast this identifier, which could be detected by interactive displays and the video cameras used to record presentations and interviews. This meant that content generated during the conference could be automatically linked to relevant delegates.

Interfaces

Access to the conference content was achieved through a diverse variety of interfaces around the venue, which



Figure 2. Scrolling displays in lecture theatres displayed messages posted on Twitter during the conference.

collectively aimed to provide access to the same content in different contexts within the conference.

Interactive Tables

Six small interactive tables were deployed around the main conference venue (Figure 1). Each table could be used to browse the programme, papers, images and videos. Attendees could highlight all content relating to them by placing their badge tag on the table surface, or use a free text search to access other content. They could also ‘like’ items of content and export these onto a USB flash drive.

The tables were designed to provide a natural gathering point for groups of attendees during breaks to encourage interaction between individuals and collaborative discovery of content. The tables were deployed in break areas and elevated to a height where they presented a natural place for food and drinks, much like the other tables located around the venue.

Twitter Displays

In each lecture theatre, a scrolling LED sign (Figure 2) displayed tweets that had been posted with the conference hashtag, showing the most recent twenty tweets in rotation. These were intended to serve a number of purposes. Firstly, it was expected that it would make the conference backchannel more visible to delegates who might not normally engage with it, broadening the conversation and potentially informing the discussion in the room during question sessions. As tweets were displayed from all rooms, it also had the potential to provide awareness of reactions to presentations in other tracks. Finally, as Twitter is not limited to those attending the conference, it also provided those not attending to have some presence in the venue.

Mobile App

A standard smartphone app, available for iOS and Android, was made available in advance of the conferences. The app’s functionality was typical of those provided by many

other conferences, with a searchable program indexed by author and institution and the ability to build a personalised itinerary for during the conference and a reading list for afterwards.

Non-Interactive Displays

A number of non-interactive information displays were also deployed around the conference venues, aimed at further increasing the visibility of content being produced during the conference. These were capable of displaying a variety of content, curated by the conference staff, including photos, videos, tweets, announcements and progress of talks in each room. Displays were located in the main venue foyer outside each of the lecture theatres and on the walls of the lunch and demo venue.

STUDY DESIGN

The above technologies and content were deployed at two conferences for the duration of the three-day events. Across both conferences 587 people attended and the majority of these attendees would have come into contact with one of the conference technologies in either the lecture theatres or social spaces. This figure excludes those who had only attended workshops, as only small portions of the technology were in use during these days.

In order to assess the impact that these deployments had on the overall conference experience, we captured a cross-section of opinions and experiences from attendees. We designed a mixed methods approach to collecting data. To gain in-depth insights into individual experiences, interviews were conducted with attendees both during and after the conferences. To gain a broader overview of the impact of our deployments, we distributed an online survey to all attendees three weeks after the conferences. This data was augmented by our own observations throughout the conferences.

Post-Conference Interviews

Four attendees in each week, representing a spectrum from experienced to novice conference-goers, were given compact video cameras with instructions to film clips illustrating their ‘conference experience’ and aspects of the conference that they found novel, interesting or problematic. These instructions were purposely left ambiguous, with the intention that participants would focus on the aspects of the conference that mattered to them most. Two to three weeks after the conference, we conducted Skype interviews with each of these attendees. During the post-conference interviews, their video footage was used to prompt discussion of their experience of the conference and whether this had been affected by the deployed technology. The interviews were between 30 and 90 minutes in length.

Opportunistic Interviews

We also conducted eleven opportunistic semi-structured interviews with other delegates during the second week.

These interviews lasted between 20 and 50 minutes each and were framed as an opportunity for delegates to talk about the sessions and activities they had participated in, with follow-up questioning from the interviewer about the use of the conference technologies. These delegates ranged from students to conference chairs and steering committee members.

Questionnaire

The survey consisted of Lickert-scale questions to gauge reactions to the overall conference and individual technologies, with open-ended questions to gather more detailed feedback. Questions asked about overall impact on the conference experience, awareness of particular pieces of technology and the impact of these technologies on the engagement with the conference. We received 135 responses to this survey, a response rate of 22%.

Analysis

Two researchers independently performed a thematic analysis [4] on the data from the nineteen interviews, which were summarised with open codes and grouped into themes. The open-ended responses were then categorised using the themes generated previously.

FINDINGS

Overall opinions on the effect of the technology were largely positive. When asked “How much did our new technology alter your conference experience?”, 55% indicated a strong or weak positive effect, 36% had a neutral reaction and only 9% indicated a strong or weak negative effect. Moreover, when asked “How open would you be to conferences implementing other new technologies in the future?”, 87% responded positively.

Although these measures were broadly positive, the qualitative feedback from both interviews and the questionnaires was more nuanced, reflecting the varied audience, technologies and settings that are part of any conference. Based on the results of our thematic analysis, the following sections examine feedback from attendees about the impact of technology on the conference experience. Quotes from attendees are attributed using the following codes: C indicates an opportunistic interview conducted during the conference, P indicates a post-conference interview conducted via Skype and Q indicates a questionnaire response.

Starting Conversations

The most common feedback from delegates was the value of technology as an icebreaker, particularly in social spaces:

“You could go up to [the] little tables and it was a good way to start getting chatting to people.” (P1)

“I think they’re a great icebreaker for groups of people to meet up.” (C1)

This ability to act as a conversation-starter was actually accentuated by the process of learning what functionality the unfamiliar interface offered. In one period of observation, a younger delegate demonstrated to a more senior academic how his badge had activated new functionality in the table. Having started discussing this new functionality, the conversation then moved on to what talks both had attended. Thus, a conversation emerged between an academic and a student that might not have otherwise occurred. Another interviewee described the act of ‘performing’ around the tables and attempting to make sense of the technology:

“In order to work out how to make them work you have to go through this [...] performance of trying to negotiate the system.” (P2)

This attendee referred to a perceived need to “work out” what the system was capable of and its purpose within the break areas. Typically this performance would be conducted by groups of younger attendees all standing around the table at once. While conversations would initially be framed around how to use the tabletop interface, these would often lead to the realisation by one of the group members that their name badge could “unlock” content related to them. We observed occasions where this would lead to each member of the group checking their content in turn. In one example this allowed a young presenter to show his paper to a delegate who had missed it. In another example, we observed great frustration on the part of one delegate who was unable to locate a paper he co-authored with his name badge.

The Twitter displays also demonstrated this ability by allowing attendees to discover others and potentially provide provocative material for discussion:

“[The displays] revitalised my use of Twitter, so I’m now friends with a fair few Twitter people on there.” (C2)

Some respondents went on to suggest that technology might be used to actively introduce strangers based on common interests, mirroring previous conference deployments:

“Maybe having some technology that helped me with recording or keeping track of whom I was talking to or maybe even to find out whom I could talk to.” (C3)

Key Finding: As supported by prior literature [18], novel technologies in the conference venue acted as shared artefacts around which attendees could converse. This seemed to be particularly effective for younger members of the community. While content of mutual interest naturally played a role in this, unfamiliarity with the technology was perhaps more effective. This suggests potential for ambiguous [13] or performative interfaces in supporting social activity, rather than the highly functional interfaces that most conferences have favoured.

Distraction

A recurring theme relating to the use of technology during talks was distraction. This was particularly true of the Twitter displays, which were active during the talks:

"I found them distracting and of limited use. The focus of the talks should really be talks, not peripheral going-ons around them." (Q8)

"They were great for in-between and before talks but quite distracting when on during a talk." (Q100)

The fact that tweets scrolled slowly across the screen was highlighted as a specific cause of distraction. Audience members needed to focus on the display to read a single tweet from beginning to end and often only saw the end of tweets, causing them to focus on the display while they waited for the tweet to appear again:

"It draws the user's eye, it's something that's moving [...] therefore you start looking at it." (P3)

"The scrolling messages take a long time to digest and take your attention away from the talks." (Q38)

There are, of course, many other potential distractions at conferences, particularly given the proliferation of wireless Internet and mobile devices. However, these require much more explicit action on the part of the user and typically do not demand attention from attendees who are otherwise engaged in the talk. The Twitter displays differed from these other distractions by changing the nature of the lecture theatre from a space with a single public focal point of attention to one with multiple channels. One attendee suggested that a more appropriate location for the displays might be outside the lecture theatres rather than inside:

"Perhaps the most useful would be to make it more available in the hallways—drawing attention to potentially exciting talks that people might want to join." (Q37)

There was a sense across the interviews and survey responses that the Twitter displays held the potential to provoke discussion if placed in appropriate locations and with appropriate content.

Key Finding: Much of the criticism received focused on technology in talks, rather than in social spaces, where it was seen as distracting from the presenter. Use of technology must take into account the considerable difference in socially acceptable behaviour between these settings. We suggest that in this setting, any introduction of technology should be closely integrated with existing practices, such as questions and answer segments.

Content Immediacy and Relevancy

Each of the deployments was designed with timeliness and relevance of content in mind. However, while the Twitter displays were intended to show tweets immediately after they were posted, they were typically delayed by over

fifteen minutes and the displays regularly showed tweets from the previous day. Likewise, due to an unanticipated workload on the behalf of the conference organisers, the interactive tables were not regularly updated with new video content. This made it difficult for the technology to provide additional channels to conference content. Many respondents who had otherwise reacted positively to the Twitter displays voiced this criticism:

"I thought they were nice, but they were often displaying dated tweets. They needed to stick to the most recent tweets or nothing at all." (Q40)

Despite these problems, or perhaps because of them, the displays served to hint at the presence of a backchannel, even if the particular tweets on display were not current. This led a number of attendees to look at the feed on their personal devices to see more current messages, or even reactivate dormant accounts in order to take part:

"I could actually see the tweets that people have sent, so that sort of motivated me to open my Twitter page." (P4)

"For me it was fun to have the boards, because otherwise it would have been completely off in that backchannel." (C4)

"There were some tweets on there that I didn't see in my Twitter stream, so actually I saw them first there and I checked up on my Twitter stream to see [them]." (C5)

Likewise, the lack of new content being added to the tables during the week caused many delegates to lose interest after initially exploring the devices. Without new content being uploaded, scanning a badge tag typically only displayed content related to that attendee's own submissions, leading many to believe that the tables were intended only for presenters:

"The content that it presented for me wasn't really anyway useful because I hadn't got any papers to present [...] it could have made you feel like you weren't part of the club." (P3)

"I see my co-authors, I see my paper, I see the picture of my paper, but what I was expecting to see was [...] with whom I was interacting." (C3)

Critically, there was a view amongst attendees that there was no function or form of content that made the technologies indispensable. This was expressed by one of our interviewees:

"I didn't see any reward necessarily for interacting with the system. It didn't quite seem game-like enough to be just a thing to play with and didn't seem directly explicitly functional enough to work out how it could benefit me." (P5)

Key Finding: Although a mass of content exists relating to any conference, it proved important to consider not just *what* content delegates would like to access but also *when*,

where and how this content will be accessed. From feedback, it is clear that these technologies missed the 'sweet spot' [23] of people, place and content required to make the installations engaging. This implies a need for a degree of context awareness, but also a need for active human curation of content throughout the conference to filter through the content and promote timely content to relevant interfaces.

Exposing the Backchannel

In displaying tweets very publicly, the Twitter displays changed the nature of the backchannel. Although publicly searchable and indexed by the conference hashtag, this content is still normally only visible to those who actively seek it out. Some immediately felt that this was detrimental to the backchannel:

"Encouraging a Twitter backchannel is a great idea but it works exactly as a backchannel and doesn't have to be broadcast." (Q104)

"It was unnerving to see them very publicly scroll across the display during the talks. In some ways, I see Twitter as being like whispering during a talk [...] You basically violated social protocol with the displays." (Q43)

It quickly became apparent that not all Twitter content was well suited for display, particularly given the limited screen estate available. Many tweets included condensed text, shortened URLs and links to external images that do not translate well into a purely textual medium. Some conference attendees also use Twitter as a note-taking tool, typically posting summaries of points made by presenters. Others use the service as a means of broadcasting events from the conference to those who are *not* in attendance, leading to tweets that might not be relevant to those who are actually present in the venue. Initially, the organiser moderating the tweets approved all content that was not offensive, but later favoured discussion-related tweets.

The mischievous tendencies of the Twitter backchannel also caused some upset. Having seen tweets displayed in the lunch venues, one attendee suggested his followers tweet jokes to the displays. One Twitter user not in attendance posted an offensive joke, which was mistakenly approved and appeared throughout the opening keynote. This was referenced by several of our interviewees:

"There has to be a way of shutting it down, so if I'm sitting there and I see [offensive content] going across, I want the override button." (C6)

"The same filters that they put on in-person behaviour don't always come out online. It doesn't mean it's a bad thing. It was just causing me to reflect on how different channels are used." (C4)

However, attendees were not unanimous on the need for moderation or curation. Some respondents suggested that the community should be trusted to police itself:

"I think the audience is smart enough to say, well that's this guy with this strange comment, I just ignore it. I'm not so much in favour of moderating or censoring it. I think the crowd could sort it by itself. Because there's not so much that actually could happen." (C3)

Key Finding: Bringing the semi-private backchannel to the foreground proved to be a controversial decision, both by changing the nature of the channel and by risking offensive content. This again suggests a need for more careful curation of content, and perhaps more explicit ways for attendees to target their backchannel content at public interfaces. Some previous examples of backchannel research, for example, have used it as part of the discussion curated by the session chair [14]. The fact that a Twitter backchannel is now present at most conferences suggests that this form of closely integrated role should be examined more closely.

Privacy

Several of the interviewees raised concerns about their privacy, especially in relation to the electronic tags. In order to ensure a critical mass of users, electronic tags were issued to all attendees in their badges. To opt out of automatic recognition, attendees could simply remove the tag or badge, or turn it to face their body, in much the same way that an attendee could hide their identity using a normal name badge. Several attendees were observed to have done this either accidentally or on purpose. While the motivation behind the design of the technology was not to locate or track attendees, those who understood how the infrared tags worked recognised the possibility of location tracking:

"I want to be a private person. I don't want to be identified and for me, having a chip on you all the time, you're traceable." (C5)

Privacy concerns were very much influenced by the audience and the conference themes. This was particularly evident during the second week, where attendees specialised in pervasive computing and there was an increased awareness of privacy issues surrounding technology. However, the fact that this all took place within the relatively 'safe' environment of an academic conference mitigated some of these concerns:

"It's a fairly trusted space [...] just in that space for that particular purpose in that community whose identity I'm familiar with and trust, I didn't have a problem with it." (P1)

In many ways, this issue of privacy exists even without new technologies: several attendees were unhappy with the extensive filming that occurred during talks and breaks. However, the use of technology, particularly technology with the ability to identify and thus potentially track individuals, makes this problem more acute.

Key Finding: While only a small number of people raised privacy concerns, they felt strongly about the issue. This highlights that care must be taken not to alienate parts of the community when introducing technologies that changes the nature of a trusted public space. Technologies that identify and potentially track attendees have an important role to play in providing contextual information, but making clear in advance what data is being collected, what it will be used for and how to opt out is vital.

Personal Devices

Although our research focused on the conference as a public space, a large amount of interesting feedback related to the use of personal devices. It is apparent from the interviews that the use of personal devices at conferences is continually shifting, as smartphones and tablets become viable alternatives to the use of laptops:

"I'm trying now not to bring my laptop to conferences [...] I only bring the tablet because I can't really do that much work on it, so I have to focus on the talk." (C6)

Many attendees made extensive use of the mobile app to schedule their week, both during and in advance of the conference. Given the popularity of the app, a number of interviewees expressed surprise that the other technologies were not integrated with it:

"I download the app, I go on the airplane, check out all the papers and look through all the sessions [...] you could give an ID that works on the app but also works on the smart tables." (P6)

Other interviewees likewise indicated that their personal device and the conference app were central to their consumption of content:

"When I click on a particular session, a particular talk, if I could get the online activity or Twitter feed, that could have been helpful." (P4)

"Generally I'll Google the author, try and find what they're working on [...] if they mention a project I'll Google that and try to work out what it is." (P1)

There were also a number of low-level technical issues reported regarding personal devices. For example, one attendee interviewed did not own a smartphone and several reported that their devices were not supported by the apps. Several others reported problems with battery life when using their device extensively during the conference.

Key Finding: The proliferation of personal devices is one of the main ways in which technology has already changed the conference experience. This role begins before the conference, often extends afterwards and overlaps significantly with functionality offered by our other technologies, such as timetabling. However, the prevalence of attendees seeking out further information about papers and presenters during talks suggests a role beyond simple timetabling applications. We see potential here for

conference applications to act as portals to a wide range of relevant background content, such as videos or weblinks, perhaps submitted by the authors as additional material.

Inspiration

As noted previously, many of those we interviewed were not fully aware of the functionality or intended purpose of the technologies. There was a process of learning how to use the technology, but this caused less obvious functionality to be missed. A very brief introduction was given in the opening plenaries, pointing attendees towards a page in the paper booklet that explained more information. However, this appeared to be insufficient:

"That uncertainty around the technology combined with my uncertainty of what would I actually need from this system meant that I didn't really ever feel motivated enough [to use it]." (P5)

However, the lack of information did have a useful side-effect by allowing the technology to act as a probe and expose and inspire desired functionality. Although the practical function of the technologies was not always understood, what was clear was that many delegates were inspired by the mass deployment. Like conferences themselves, technology probes [16] act to expose possibilities and inspire new ideas. In this vein, the most encouraging feedback suggested that the different devices helped seed discussions about how the ideas embodied by the technologies could be used in other domains and be iterated in the future. The interviews were replete with functionality suggestions and at least one interviewee expressed interest in technology deployments at future conferences they were involved in. This was particularly true during the second week, due to the focus on pervasive technologies:

"We talk about this kind of technology and most of us are trying to invent some of the technologies in this area, but I don't know whether we all really live with these technologies." (C7)

"It's more the spirit, that you're willing actually to add technology to the conference now as a communication means, but also as inspiration [...] I'm quite excited about it." (C8)

In some instances this allowed delegates to reflect on their own research interests in relation to the technologies. Attendees with interests in social media discussed the ethical and social implications of publicly displaying Twitter content publicly in this context. One privacy expert had thought extensively on issues surrounding identity and tracking at the conference, while others discussed the tags as an example of a potentially invasive system. Clearly the technologies provoked discussion and yielded a large number of recommendations on how similar technologies could be better integrated in the conference to meet the needs of attendees.

Key Finding: The inspirational qualities of the deployments were a surprising finding, and while this is certainly dependent on the backgrounds of the attendees and is unlikely to hold true in other fields, it reaffirms the value of HCI conferences as a deployment environment. To make the most of this potential, we suggest further opening the conference to the community. For example, conferences might make their data and content available to attendees via standard APIs, allowing attendees to create their own innovative conference technologies.

DISCUSSION AND FUTURE DIRECTIONS

We began this paper by discussing three themes that pervade existing attempts to deploy technology in the conference environment: supporting social interaction, making content available and presenting a cohesive experience. Based on a major deployment of technologies representative of these goals, we have been able to examine how delegates responded to an augmented conference environment. Following an analysis of data collected throughout the deployments, we now suggest three new themes for future conference technologies: crowd curation, opening access and integration.

Crowd Curation

While we saw many examples of delegates playfully engaging with the interfaces themselves, we saw relatively few instances of delegates meaningfully engaging with content. A number of delegates interviewed described how the content being displayed was not useful to them at that time. Part of this problem was in the choice of content, while part was that the volume of content often appeared to be too high. It was therefore challenging to discover content relevant to an individual. For example, most talks were filmed and added to the system, but carefully selected highlights would have been more valuable. While there was an attempt to curate content for each of the interfaces by the organisers, the volume of content and rigors of running a conference meant that this was rarely achieved to the extent that had been intended.

Consequently, we are led to think that crowd curation of content within the conference environment might be one method of filtering through the data to capture the moments that make conferences memorable. We draw a distinction here between moderation and curation: we are less concerned with what is and isn't appropriate, which communities are well equipped to decide for themselves, but more about determining what is valuable. Thus, we see this as a role not just for conference organisers and session chairs, but also for speakers and attendees. For example, attendees might upload their own media, nominate insightful tweets or share interesting moments, such as when a projector failed and the speaker went on to give a well-received talk without visual aids, which was widely discussed on Twitter and amongst attendees afterwards. We see this as a way of creating a digital conference that

reflects the audience and the way in which they make every conference unique. How to go about capturing, selecting and presenting such highlights would be a fruitful topic for future research.

Opening Access

Being able to conduct such an extensive deployment put us in a privileged position. While we had access to all aspects of the conference, few attempts at developing conference technologies have this luxury. Given the wide ranging skills found in our field, we believe that innovation in conference technologies would be greatly boosted by opening up conferences—specifically their data and content—to the delegates. We frequently found that the deployments caused discussion and reflection on attendee's own work, and provoked what one attendee described as a "sense of misadventure". We believe that this interest and enthusiasm could itself be harnessed to drive forward technologies in the conference setting.

In much the same way that our own deployments consisted of a number of interfaces onto a common pool of data, we can imagine open APIs or data sets allowing wider access to the conference's content. This might include papers and metadata, other materials made available by the authors and content generated during the conference, specifically crowd-curated content as described above. We can imagine this being utilised to develop innovative technologies as part of student competitions, workshops or demo sessions, for example, or to develop mobile or web application that allow new methods of access to content. This might extend beyond attendees to those who are part of the community but not attending the conference. Like crowd curation, the aim of this theme is to share control of the conference with attendees and recognise that this is an area in which many have expertise.

Integration

To a large extent, most conference technology deployments have been seen as novelties that have not truly integrated with normal conference activities—or rather, that the intention of the technology to not align with delegates' activities. The notable exceptions that have crossed over into being truly useful and integrated parts of the conference experience have been mobile applications and Twitter. These presented new capabilities to attendees by offering a more convenient timetable and by allowing discussion and within talks and around the conference. This prompts us to consider carefully what the benefits of new conference technologies are and where they might best fit into the conference environment.

We have already suggested a number of ways that technologies like those we have deployed might play more integrated roles in the conference experience. These might include offering additional background material for talks, or by directly informing the topics of discussion during the question segments of sessions. Other examples might be in

extending discussion around the conference beyond the venue to members of the community who are not attending. Each of these examples extends existing activities in ways that closely align both with current conference behaviour and current technology use. Ultimately our aim should be to extend the conference experience without detracting from what is, at its core, an event about networking and learning. Beyond this, we see a need to scaffold delegates' expectations *before* the conference, not just on arrival. Most conference attendees know roughly what to expect from past experience and thus already have some idea of where they might find, for example, timetabling information. Beginning the role of technology in advance, as we saw with use of the mobile app, might allow us to begin gathering content and for attendees to begin integrating new technology into their routines.

SUMMARY

In this paper, we have described a large-scale deployment representing current trends in the area of conference technologies, including both past research and developments seen in recent conferences. Through this deployment, we have contributed both a wealth of data relating to attendee's experiences of a digitally augmented conference, and suggestions for future directions in developing such technologies. Overall, while the response to this technology was largely positive, we also saw that engagement with the content was relatively low, suggesting a need for further work to identify how to deliver content and functionality that closely aligns with the needs of conference attendees.

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